

Attorney's Docket No.: 13076-002001 / AAMOSPO1

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Bruce Radl
Serial No. : 09/966,484
Filed : September 28, 2001
Title : IMAGING WITH SPECTRALLY DISPERSIVE ELEMENT FOR ALIASING
REDUCING

Art Unit : 2612
Examiner : Matthew L. Rosendale

MAIL STOP AF

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY B TO ACTION OF NOVEMBER 5, 2003

Dear Commissioner:

Responsive to the Office Action of November 5, 2003, Applicant submits the following remarks.

Claims 1-6, 8 and 9 are presented for reconsideration without amendment in light of the following authorities and remarks.

1. Claims 1-6, 8 and 9 stand rejected under 35 U.S.C. §102(b) as being anticipated by Langworthy. Referring to claim 1, the reference is said to disclose an electro-optical apparatus in FIG. 13 comprising a lens 10, a CCD image sensor 20 having a pattern of color sensitive pixels, and a spectrally dispersive element comprising dichroic mirrors 72, 74, 76 and 78 between the lens 10 and CCD 20 (Col. 6, Lines 6-34).

2. Referring to claim 2, the reference is said to disclose a Bayer filter pattern as said to be shown in FIG. 14.

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3. Referring to claim 3, the reference is said to disclose an alternative embodiment where the color filter pattern is a tri-stripe said to be shown in FIGS. 7 and 8.

4. Referring to claim 4, the reference is said to disclose color-sensitive pixels arranged in continuous groups having a red pixel and blue pixel as said to be shown in FIG. 14. The spectrally dispersive element is said to be element 72, element 74, element 76 and element 78, and the lens 10 is said to be shown in FIG. 13 configured to focus a line image of an optical point by optically shifting object light upon a line of a group with the red end of the line within the red pixel and the blue end of the line within the blue pixel (Col. 6, Lines 6-34).

5. Referring to claim 5, the reference is said to disclose a Bayer pattern said to be shown in FIG. 14 having continuous 2 x 2 pixel groups having a red pixel adjacent to a first and second green pixels adjacent to a blue pixel.

6. Referring to claim 8, the reference is said to disclose a spectrally dispersive element comprising dichroic mirror elements arranged so that red and blue images are optically shifted to coincide geometrically at a point on the CCD image sensor (Col. 6, Lines 6-34).

7. Referring to claim 8, the reference is said to disclose a method of optical processing by focusing an image upon a CCD with a spectrally dispersive element [not identified] between the lens 10 and array 20 said to be shown in FIG. 13 (Col. 6, Lines 6-34).

8. Referring to claim 9, the reference is said to disclose a method of optically shifting red and blue images to coincide geometrically on the sensor array as said to be shown in FIG. 13 (Col. 6, Lines 6-34).

This ground of rejection is respectfully traversed.

We rely on the authorities set forth on pages 6 and 7 of the response filed September 18, 2003. The basic fallacy in the rejection is treating the four elements 72, 74, 76 and 78 as the single dispersive element called for by the claims.

Consider the following definitions: Element: 1. A fundamental, essential or irreducible constituent of a composite entity. The American Heritage Dictionary of the English Language (4th Ed. 2000 Houghton Mifflin Company).

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Optical definition: Element: A lens, window, mirror, prism, wedge, or other unit, usually made of glass, that is used in an optical instrument to control light. Practical Optics (1983 IMP).

Used in context: Lens, compound: A lens composed of two or more separate pieces of glass or other optical material. These component pieces or elements may or may not be cemented together. A common form of compound lens is a two-element objective, one element being a converging lens of crowned glass and the other a diverging lens of flint glass. Medical Dictionary Search Engine, <http://www.books.md/index.html>. A dispersive optical element as disclosed and claimed in this application is a one-piece simple component. For example, the wedge shown in FIG. 3 is a flat, polished piece of optical glass. To refer to the four reflectors in the reference as an element is incorrect. The reference never refers to these four reflectors as an element. Furthermore, these four reflective elements are not a dispersive element since this set of elements does not provide dispersion.

The reference discloses dichroic mirrors. Each dichroic mirror divides a light beam into two distinct colors (di=two, chroma=color). By using multiple mirrors in series the reference makes the image divide into three distinct color images, a red, green and blue. In fact, the mirrors, being partial reflectors, will also produce a series of ghost images from multiple reflections. In this way the red image is separated from the green image and both are separated from the blue image. A white image point will therefore become three points, one red, one green and one blue.

In accordance with the invention disclosed and claimed in this application, Applicant passes the image rays through a dispersive element (the wedge prism in FIG. 3) so that a white point becomes a line segment with colors dispersed all along the segment in proportion to their wavelength. It is a continuous line looking like a rainbow.

The reference discloses a fold in the optical path. Folded systems are inherently limited in angle. Wide angle cones cannot be folded. The reference separates colors laterally but also (and by an equal amount) separates them into planes of focus. Red would focus before green and green before blue by the same amount that they are shifted laterally. This arrangement means

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that all colors can no longer be focused on the plane of CCD. The reference introduces unwanted secondary reflections. These reflections produce defocused ghost images that will degrade the sharpness and resolution.

In contrast, the invention disclosed and claimed in claim 1 and the claims dependent thereon is an in-line device allowing wide angle optical paths, preserves the one plane of focus for all colors and produces no intentional reflections and may be antireflection coated to be free from ghost images. The invention of claim 1 calls for a single optical element that is far easier to produce and use than the four-mirror device disclosed in the reference.

Claims 2-6 are dependent upon and include all the limitations of claim 1, and the reasoning in support of claim 1 is submitted to support the patentability of claims 2-6 so that further discussion of these claims is submitted to be unnecessary. Furthermore, with respect to claim 4, the Examiner incorrectly states that the four dichroic mirror elements 72, 74, 76 and 78 and the lens 10 shown in FIG. 13 are configured to focus a line image of an optical point. The four dichroic mirrors will not create a line image. They will produce three points from one point. These points will also be corrupted by the ghosts and focus errors discussed above.

Both claims 8 and 9 are restricted to the method of optical processing including focusing the image of an object upon a photoelectric array with a spectrally dispersive element between the lens and array. We have shown above that the reference does not disclose a spectrally dispersive element; therefore, it is impossible that it discloses focusing the image of an object upon a photoelectric array with a spectrally dispersive element between the lens and array.

In view of the foregoing authorities, reasoning and the inability of the prior art to anticipate, suggest or make obvious the subject matter as a whole of the invention disclosed and claimed in this application, all the claims are submitted to be in a condition for allowance, and notice thereof is respectfully requested. Should the Examiner believe the application is not in a condition for allowance, he is respectfully requested to telephone the undersigned attorney at (617) 521-7014 to discuss what additional steps he believes are necessary to place the application in a condition for allowance.

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Please apply the one-month extension of time fee of \$55.00 to deposit account 06-1050,
Order No. 13076-002001.

Respectfully submitted,

FISH & RICHARDSON P.C.

Date: FEB 13 2004

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